

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Article 36 and Rule 70)

REC'D 07 OCT 2004

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Applicant's or agent's file reference
P200201037 WO

FOR FURTHER ACTION

See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)

International application No.
PCT/EP 03/14486

International filing date (day/month/year)
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17.01.2003

International Patent Classification (IPC) or both national classification and IPC
H04L7/02

Applicant

TELEFONAKTIEBOLAGET LM ERICSSON (publ) et al

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 8 sheets, including this cover sheet.
 - ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand

26.07.2004

Date of completion of this report

06.10.2004

Name and mailing address of the international preliminary examining authority:



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized Officer

Baltersee, J

Telephone No. +49 89 2399-7126



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP 03/14486

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-27 as originally filed

Claims, Numbers

1-27 as originally filed

Drawings, Sheets

1/7-7/7 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written-sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/EP 03/14486**

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | |
|-------------------------------|-------------|-------------------------|
| Novelty (N) | Yes: Claims | 1-14, 18, 21, 22, 25-27 |
| | No: Claims | 15-17, 19, 20, 23, 24 |
| Inventive step (IS) | Yes: Claims | 7, 8, 21, 22 |
| | No: Claims | 1-6, 9-20, 23-27 |
| Industrial applicability (IA) | Yes: Claims | 1-27 |
| | No: Claims | |

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. The following documents (D1-D2) are referred to in this communication; the numbering will be adhered to in the rest of the procedure:

D1: ROO P ET AL: 'ANALOG TIMING RECOVERY ARCHITECTURES FOR PRML DETECTORS' GLOBECOM '95. IEEE GLOBAL TELECOMMUNICATIONS CONFERENCE. SINGAPORE, NOV. 14 - 16, 1995, IEEE GLOBAL TELECOMMUNICATIONS CONFERENCE (GLOBECOM), NEW YORK, IEEE, US, vol. 1, 14 November 1995 (1995-11-14), pages 571-576, XP000621549 ISBN: 0-7803-2510-9

D2: MUELLER K H ET AL: 'TIMING RECOVERY IN DIGITAL SYNCHRONOUS DATA RECEIVERS' IEEE TRANSACTIONS ON COMMUNICATIONS, IEEE INC. NEW YORK, US, vol. 24, no. 5, 1 May 1976 (1976-05-01), pages 516-531, XP000573328 ISSN: 0090-6778

The requirements of Article 6 PCT

2. The application does not meet the requirements of Article 6 PCT, because claims 1, 15 are not clear.
- 2.1 Claims 1 and 15 are not supported by the description as required by Article 6 PCT, as their scope is broader than justified by the description and drawings. The reasons therefor are the following:

According to claim 1, an error metric is evaluated as a function of the error metric and symbol values. The description clearly conveys the impression that evaluation of the metric involves the technical features of either dependent claim 6 or alternatively claims 7 and 8, and no other possibilities are envisaged or detailed. Similarly, whether to shift the phase of the sampling points in time or not is based on further evaluation of the error metric. The description, however, clearly conveys the impression that further evaluation of the error metric involves the technical features of dependent claims 9 and 10, and no other possibilities of further evaluation are envisaged or detailed. Therefore, claim 1 does not meet the requirements of Article 6 PCT.

An independent apparatus claim which meets the requirement of Article 6 PCT would include either all the features of claims 1, 6, 9 and 10 or, alternatively, 1, 7, 8, 9 and 10.

The same objection also applies to independent claim 15, which contains the same technical features as claim 1, but expressed in terms of a method claim. An independent method claim which meets the requirements of Article 6 PCT would either include all the features of claims 15, 20, 23, 24 or, alternatively, 15, 21, 22, 23, 24.

- 2.2 Claims 1 and 15 do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The phrase "further evaluation of the error metric" (page 28, line 17; page 30, lines 32+33) is vague and imprecise and may refer to an infinity of possibilities with regard to what kind of evaluation is meant. Thus, the reader is left in doubt as to the meaning of the technical feature to which said phrase refers, thereby rendering the definition of the subject matter of claims 1 and 15 unclear (Article 6 PCT).
- 2.3 Dependent claim 27 does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The term "reference value" is not defined in either claim 27 or in any one of claims 15-26 that claim 27 depends on, thereby rendering the definition of the subject-matter of claim 27 unclear (Article 6 PCT).

The requirements of novelty and inventive step

- 3.1 The present application does not meet the requirements of Article 33(2) PCT, because the subject-matter of claim 15 is not novel.

The document D1 discloses, according to all the features of claim 1 (the references in parentheses applying to this document):

A method of processing a signal (see last paragraph of left-hand column of page 571; timing recovery is a method of processing a received signal), comprising the steps of :

demodulating a received signal (see page 571, Section II, lines 6 up to and including equation (1); an equalizer according to equation (1) demodulates the

received signal), which carries consecutive symbols at a symbol rate (see page 571, Section II, lines 1-6), and based on sample values of the received signal, calculate an error (e_k) value of a given symbol relative to a decision-directed determination of an expected symbol value (see equation (2) which calculates such an error value e_k);

and shifting the phase of sampling points in time (see Figure 1 with a voltage controlled oscillator (VCO) that shifts the sampling phase);

characterized in further comprising the step of

evaluating an error metric (z'_k), at the symbol rate, for a given symbol as a function of the error value and symbol values (see equation (3) which calculates such an error metric z'_k), and to determine whether to shift the phase of the sampling points in time based on further evaluation of the error metric (see the loop filter in Figure 1 which processes the error metric z'_k to produce c_k which in turn steers the VCO, c.f. explanation underneath Figure 1).

The subject-matter of claim 15 is therefore not novel in the sense of Article 33(2) PCT.

3.2 Moreover, it should be noted that even if novelty of claim could be argued, based on minor differences between the features of this claim and those disclosed in D1, the subject-matter of claim 15 would not involve an inventive step, Article 33(3) PCT, having regard to the disclosure of D1.

4. The present application does not meet the requirements of Article 33(3) PCT, because the subject-matter of claim 1 does not involve an inventive step.

Claim 1 is an apparatus claim corresponding to method claim 15 in that it carries out the same function, namely estimating and adjusting for a timing error. Therefore, claims 1 and 15 do not exhibit any functional differences.

Claim 1, however, differs structurally from the disclosure of document D1 in that the demodulator is arranged to calculate the timing error, whereas in D1 the timing error is calculated in the phase detector (Fig. 2). Furthermore, in claim 1, a processor evaluates the error metric and determines whether to shift the phase of the sampling points, whereas in document D1, the error metric is evaluated by the

phase detector, and whether to shift the sampling phase is determined by the VCO on the basis of the output of the loop filter.

Whether to consider the phase detector as part of the demodulator is just a matter of definition, without any technical effect or technical advantage. Furthermore, it is customary practice to carry out specific functions of receiver equipment by dedicated processors. It would thus be obvious to a skilled person that evaluation of the error metric and determination of whether to shift the sampling phase can be carried out by such a processor.

Thus, the subject-matter of claim 1 does not involve an inventive step and does not satisfy the criterion set forth in Article 33(3) PCT.

5. The present application does not meet the requirements of Article 33(3) PCT, because the subject-matter of claim 14 does not involve an inventive step.

It is a common measure for a person skilled in the art to include means for timing estimation and timing adjustment in a mobile phone, since both functions are an integral part of virtually any wireless communication system. Claim 1 describes a signal processing apparatus for precisely that purpose. Therefore, it would be obvious for the person skilled in the art to include an apparatus according to claim 1 in a mobile phone.

6. The additional features of the dependent claims 2-6, 9-13, 16-20, 23-27 do not add anything which would result in novel and inventive independent claims, because these features are either known from the above prior art D1-D2, for example,

- claims 2, 3, 5, 6, 9, 10, 16, 17, 19, 20, 23, 24; see document D1, Section II, Figures 1 and 2, Table 2, and equation (12)
- claims 11, 25; see document D2, page 518, right-hand column, and paragraph after equation (45)

or common design measures, for example,

- claims 4, 18; PSK or DPSK demodulation
- claims 12, 26; control of timing phase by selecting an appropriate phase out of the multiple phases of an oversampled signal.

- claims 13, 17, 27, semi-coherent demodulation

7. The combination of the features of dependent claims 7 and 8 (for the apparatus) or dependent claims 21 and 22 (for the method) is neither known from, nor rendered obvious by, the available prior art (see, however, comments in Section 2.1 of this international preliminary examination report), and thus these dependent claims meet the requirements of Article 33(3) PCT.

The requirements of industrial applicability

8. The claims 1-27 meet the requirements of Article 33(4) PCT with respect to industrial applicability.

Formal points

9. According to Rule 6.2(b) PCT, the technical features mentioned in the claims shall preferably be followed by reference signs, if the intelligibility of the claim can thereby be increased. Claim 1, however, makes reference to a processor with reference sign 1000, which does not seem to appear in either description or drawings and thus does not increase the intelligibility of claim 1. Furthermore, according to the requirements of Rule 10.2 PCT the same feature shall be denoted by the same reference sign throughout the application. This requirement is not met in view of the use of reference sign 601, which is also used in claim 1 to refer to a processor, but is used inconsistently in this respect in Figures 6a and 6b.